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(54) **Two-sided, light-readable information recording disc stacks and methods of making same**

Doppelseitige optisch lesbare Informationsaufzeichnungsplattenstapel und Verfahren zu deren Herstellung

Piles de disques à double face pour l'enregistrement d'information lisibles optiquement, et méthodes de fabrication

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Description

Background of the Invention

[0001] This invention relates to information recording media in the form of light-readable discs, and more particularly to such media which are made up of two such discs secured to one another back to back to form a two-sided stack.

[0002] Light-readable information recording media in the form of discs are well known as shown, for example, by Kramer U.S. patent 5,068,846. Commercially available compact discs ("CDs") and compact disc read-only memories ("CD-ROMs") are examples of recording media of this general type.

[0003] US patent 5,068,846 discloses a record carrier having a substrate provided with a crenellated surface that can be read optically, for example by laser. In addition, a protective layer is present, to protect the optically read surface and a sheet of paper or foil of a synthetic material may be stuck onto the optical surface or structure.

[0004] Recently there has been interest in using recording media of this type for recording other kinds of information such as movies or other similar real-time audio/visual programming. The information content of such programming is much greater per unit of real time than the information content of audio-only programming such as is now found on commercial CDs. In addition, movies or the like are often much longer than audio programming. A movie may run two hours or more, while it is very rare for any piece of music to run even as much as an hour. Discs that are substantially larger than audio CDs have been used for this type of programming, but these larger discs are unwieldy as compared to audio CDs, and it would be more convenient and commercially acceptable to use discs that are of the size of conventional audio CDs for this programming. Advances have been made in fitting more information onto discs of audio CD size. However, relatively long audio/visual programs still will not fit on one disc of conventional audio CD size. It has therefore been proposed to standardize on audio/visual programming discs that look somewhat like two conventional audio CDs that are bonded back to back in a stack. This doubles the playing time as compared to a single-sided disc, without significantly increasing the physical size of the disc structure as compared to a conventional audio CD.

[0005] While there is sufficient relatively long audio/visual programming to warrant standardizing on the two-sided disc stack described above, there is also a very large amount of potential programming that will fit entirely on one side of such a stack, with no need for any part of the programming to continue on to the second side as is required for longer programming. Nevertheless, for all disc structures to be physically the same (e.g., for physical compatibility in playback equipment) two back to back discs must always be provided. Thus,

if the programming is relatively short, the second disc in such a stack may be "blank", i.e., with no real programming information recorded on it.

[0006] Patent abstract of Japan, volume 17, number 239 (P-1572), 12 July 1993, and JP-A-05054599 (NEC Corp), discloses an optical disc formed from two "back to back" substrates. The respective substrates are affixed together by means of an adhesive layer so that sides of the substrates provided with optically readable information face one another. That is, the optically readable surfaces are on either side of the adhesive layer and face inwardly. In addition, the outer surfaces of the optical disc, i.e. the surfaces to be irradiated with a laser beam, may be provided with printed information.

[0007] However, the discs described in that document are conventional each having an optically readable surface and an outer printed surface. Also, there is no disclosure of the use of the second disc additionally for displaying identifying information when it is not needed to contain programmed information, as described below in the present application.

[0008] In view of the foregoing, it is an object of this invention to make use of the second disc in a two-disc stack of the type described above when the second disc is not needed to record programming information.

[0009] It is another object of this invention to provide improved methods for making two-disc stacks of the type described above when the second disc in the stack is not needed to record programming information.

Summary of the Invention

[0010] The invention is specified in the independent claims 1 and 9, specific embodiments of the invention are specified in the sub-claims.

[0011] Thus these and other objects of the invention are accomplished in accordance with the principles of the invention by providing information recording media made up of two discs secured back to back in a two-disc stack. A first disc in the stack is constructed generally as shown in Kramer U.S. patent 5,068,846. This first disc therefore has light-readable programming information recorded on it in the known fashion. The second disc in the stack has no real programming information recorded on it, but it does bear some visually perceptible indicia. Preferably at least a portion of these indicia is generic (i.e., not specific to the particular programming on the first disc). For example, this generic portion of the visible indicia may include information identifying the manufacturer of the recording media and/or the general class of the programming on the first disc (e.g., a general movie theme or a general cartoon theme). Another portion of the visible indicia on the second disc may be specific to the programming on the first disc. For example, this second portion of the visible indicia may include the title of the programming on the first disc.

[0012] The visible indicia may be placed on the second disc in any of several different ways and at different

times. For example, the visible indicia may be produced by modifying the surface of the second disc (e.g., by laser scribing, thermal branding, or the same technique that is used to record information on the first disc but with the pattern of the surface modifications having features that are large enough to be visible to the unaided eye). The visible indicia may be placed on the second disc before or after the first and second discs are bonded together. Or some of the visible indicia may be placed on the second disc before such bonding, while other visible indicia are placed on the disc after such bonding.

[0013] Although there is no real programming recorded on the second disc, some generic information may be recorded on that disc in the same light-readable form that the programming information is recorded on the first disc. For example, this generic digital information may cause playback apparatus to display a message such as "Wrong side -- turn disc over."

[0014] In accordance with the methods of this invention, different "first discs" of the type described above are made with different programming recorded on them. "Second discs" of the type described above are made with generic information on them. This generic information may include the generic recorded information (e.g., the above-mentioned message "Wrong side -- turn disc over") and/or generic visible indicia of the type described above. A second disc is then bonded to each first disc. In relatively close association with the bonding step (i.e., shortly before, during, or shortly after the bonding step) additional visible indicia may be added to the second disc that is specific to the programming on the first disc. This method allows generic second discs to be manufactured in advance and stockpiled until they are needed for bonding to many differently recorded first discs. This has several advantages such as helping to even out the workload of production machines and personnel, simplifying the operations required to produce finished two-stack discs, etc.

[0015] Further features of the invention, its nature and various advantages will be more apparent from the accompanying drawings and the following detailed description of the preferred embodiments.

Brief Description of the Drawings

[0016] FIG. 1 is a simplified elevational view of one side of an illustrative recording medium constructed in accordance with this invention.

[0017] FIG. 2 is a simplified elevational view of the opposite side of the recording medium shown in FIG. 1.

[0018] FIG. 3 is another simplified elevational view taken along the line 3-3 in FIG. 2.

[0019] FIG. 4 is a simplified sectional view taken along the line 4-4 in FIG. 2.

[0020] FIG. 5 is a view similar to FIG. 2 showing another illustrative embodiment of a recording medium constructed in accordance with this invention.

[0021] FIG. 6 is a view similar to FIG. 4 showing an-

other illustrative embodiment of a recording medium constructed in accordance with this invention.

[0022] FIG. 7 is another view similar to FIG. 4 showing yet another illustrative embodiment of a recording medium constructed in accordance with this invention.

[0023] FIG. 8 is another view similar to FIG. 2 showing a possible additional feature of the embodiment shown in FIG. 7.

[0024] FIG. 9 is a simplified flow chart showing illustrative methods of making recording media in accordance with this invention.

[0025] FIG. 10 is another view similar to FIG. 2 showing still another illustrative embodiment of a recording medium constructed in accordance with this invention.

Detailed Description of the Preferred Embodiments

[0026] As shown in FIGS. 1-4, an illustrative two-disc stack 10 has first and second discs 20 and 40 bonded to one another back to back to form the stack. Each of discs 20 and 40 has a central aperture. In stack 10 these apertures line up with one another to form central stack aperture 12 by which the stack can be placed on a spindle to rotate it about axis 14 for playback of information recorded on the stack.

[0027] In stack 10 programming information is recorded on disc 20 in light-readable form in the conventional manner (e.g., generally as shown in Kramer U.S. patent 5,068,846). Thus disc 20 typically includes a transparent plastic disc 22, the upper surface of which (as viewed in FIG. 4) is patterned as shown at 24 to record programming information. The features of this pattern are sometimes referred to as "pits". These pits are arranged in concentric rings or a continuous spiral substantially concentric with axis 14. A layer 26 of highly reflective material such as aluminum is deposited on patterned surface 24. In this way light (typically laser light) directed in through disc 22 toward pattern 24 is reflected back out through disc 22 differently depending on whether the light strikes a high or low spot in pattern 24. The light thereby reads the programming information recorded by pattern 24 in order to play back that programming. The recording scheme may be digital.

[0028] To protect reflective layer 26 a resin layer 28 (e.g., a layer of lacquer) is deposited on the side of layer 26 which faces away from pattern 24.

[0029] Although the second disc 40 in stack 10 may have other constructions (described below), in the simplest case (illustrated by FIG. 4) disc 40 is a simple plastic disc 42, preferably of the same material as disc 22 and having substantially the same thickness as the combined thickness of components 22, 26, and 28. Disc 40 is bonded to the exposed surface of layer 28 (e.g., by means of a hot melt glue layer 30).

[0030] As shown in FIG. 2 disc 40 displays indicia 60 that are visible to the naked eye. In the particular example shown in FIG. 2 these indicia include the words "HOME VIDEO", "THIS SIDE UP", and "Unauthorized

duplication is a violation of law", as well as an annular band 64 of artwork between the two annular bands 62 and 66 of text. Preferably at least some of these indicia are generic, i.e., not specific to the particular programming recorded on the first disc 20 in stack 10.

[0031] Indicia 60 can be applied to disc 40 in any of several ways. For example, indicia 60 can be printed on either side of disc 40 before discs 20 and 40 are bonded together. Or indicia 60 can be printed on the exposed surface of disc 40 after discs 20 and 40 have been bonded together (although it is preferred that at least the generic indicia are applied to disc 40 before bonding to disc 20.) As another example, a printed label (e.g., of paper) may be applied to the surface of disc 40 that is otherwise exposed in stack 10. Such a label may be applied either before or after discs 20 and 40 are bonded together, although it is again preferred that generic indicia are applied to disc 40 prior to bonding to disc 20. FIG. 5 shows an illustrative example 10a in which visible indicia 72 are printed on an annular paper label 70 which is glued to the otherwise exposed surface of disc 40.

[0032] Still another way that visible indicia 60 may be applied to disc 40 is by locally modifying a surface of disc 40. In the illustrative alternative embodiment of the invention 10b shown in FIG. 6 the exposed surface of disc 40 is depressed as at locations 80 to provide visible indicia on the disc. These modifications of the surface of disc 40 may be produced in any of several ways such as by thermal branding (i.e., pressing a heated metal pattern against disc 40), by laser scribing, or by selective chemical etching. Again, this modification of the disc surface may be performed before, after, or even during bonding of discs 20 and 40 together, but it is preferred that generic indicia are applied to disc 40 prior to such bonding.

[0033] Another example of modifying a surface of disc 40 to provide visible indicia on that disc is shown in FIG. 7. In this embodiment technology similar to that used to record programming on disc 20 is used to provide visible indicia on disc 40. Thus in this embodiment disc 40 includes a transparent plastic disc 42 with a pattern 44 of surface modifications on one side. Pattern 44 is covered by a layer 46 of highly reflective material such as aluminum. Layer 46 is protected by a layer of lacquer 48. Pattern 44 includes at least two kinds of regions 44a and 44b. In regions 44a pattern 44 includes many small features (like pattern 24). In regions 44b, however, pattern 44 is smooth over relatively large areas. Light passing into disc 42 is reflected back through the disc visibly very differently depending on whether the reflection is from a region 44a or a region 44b. Regions 44a tend to scatter the light and therefore appear frosted, while regions 44b have a more mirror-like appearance. These visibly contrasting regions can be used to provide any desired visible indicia. For example, line work for lettering or to outline graphics can be provided by lines done like regions 44b against a background like regions 44a. Or lines done like regions 44a can be against a background done

like regions 44b. Figures can be done with large areas like regions 44a against a background like regions 44b. Or a figure can be done with large areas like regions 44b against a background like regions 44a. Halftone-type shading can be provided by alternating regions like 44a and 44b. Visible indicia produced in this way are sometimes referred to herein as "pit art" because of the use of "pits" like those in pattern 24 to produce some of the features of the indicia.

[0034] Constructing two-disc stack 10c as shown in FIG. 7 has the additional advantage that a portion of pattern 44 can be used to record some generic information that is light-readable for playback in the same way that the programming information can be played back from pattern 24. For example, FIG. 8 shows that in addition to visible indicia 80 in text bands 82 and 86 and graphics band 84, pattern 44 may include a small band 88 of generic light-readable information that causes the disc playback apparatus to display a generic message (e.g., "Wrong side -- turn disc over") when band 88 is read in the same way that the playback apparatus would read pattern 24 on disc 20.

[0035] FIG. 9 illustrates preferred methods of making discs 10 in accordance with this invention. In step 110 generic discs 40 are made (e.g., using apparatus of the general type that is conventionally used to make CDs or CD-ROMs). Step 110 may include one or more of substeps 112, 114, and 116. Substep 112 is the printing of generic visible indicia on each disc 40 as has been described above. Any of several printing techniques may be used such as silk screen printing or offset printing. Substep 114 is applying a label bearing generic visible indicia to each disc 40 as described above. Substep 116 is modifying a surface of each disc 40 to produce visible indicia on the disc. Substep 116 may be performed using one or more of further substeps 116a, 116b, and 116c. For example, further substep 116a is thermal branding; further substep 116b is laser scribing; and further substep 116c is the provision of pit art as is described above in connection with FIG. 7. (As mentioned above in connection with FIG. 8, step 116c may additionally or alternatively record a generic light-readable message (band 88) on each disc 40.)

[0036] Generic discs 40 leaving step 110 may go directly to step 150 or they may be stockpiled in step 120 for future use in step 150.

[0037] In step 130a program discs 20 recorded with programming information "A" are made (e.g., again using apparatus of the general type that is conventionally used to make CDs or CD-ROMs). For example, programming information "A" may be a science fiction film. In step 130b different discs 20 are made with different programming "B" recorded on them. For example, programming "B" may be a cartoon film. Additional different program discs 20 may be made with still other programming recorded on them in other steps 130 (e.g., in step 130n).

[0038] Program discs from step(s) 130 may go direct-

ly to step 150 or they may be stockpiled in step 140 for future use in step 150.

[0039] When step 150 is performed, a generic disc 40 from step 110 or stockpile step 120 is bonded back to back with each program disc from a step 130 or from stockpile step 140. Step 150 may include one or more of substeps 152, 154, and 156 if it is desired to add specific visible indicia to discs 40. Such additional visible indicia are specific to the programming recorded on the disc 20 to which that disc 40 is bonded. For example, the additional specific visible indicia can be the title of the programming on the associated disc 20. An illustration of this is provided in FIG. 10 where the specific visible indicia 90 (i.e., "David Copperfield") is added to disc 40 in step 150 to identify the programming on the associated disc 20 as a movie entitled "David Copperfield". Substep 152 is a printing step similar to above-described step 112. Substep 154 is a labelling step similar to above-described labelling step 114. Substep 156 is a surface modification step similar to above-described step 116. Substep 156 may be performed by way of further substeps 156a and/or 156b, which are respectively similar to further substeps 116a and 116b. Substeps 152, 154, and/or 156 may be performed at any convenient time relative to the actual disc bonding portion of step 150. For example, substeps 152, 154, and/or 156 may be performed before or after discs 20 and 40 are bonded together in step 150. Substep 156a can be performed at either of these times, or it can be performed during the bonding of the discs as part of an operation that presses together the two discs being bonded.

[0040] The end products of step 150 are finished discs 10 (which is a generic reference to any of the various types of discs 10, 10a, 10b, 10c, and 10d shown in the other FIGS.).

[0041] Producing discs 10 using the methods illustrated by FIG. 9 has a number of advantages. For example, generic discs 40 can be made in large quantities in advance of the need for them to be bonded to discs 20. All or substantially all of the work that is needed on these discs 40 can be done on them in advance in step 110. If all the visible indicia that are needed are generic, step 150 can be just the extremely simple and rapid step of bonding two discs 20 and 40 together. Or even if some specific visible indicia are to be added in step 150, that visible indicia can be kept relatively simple and easy to apply because it is only an addition to more sophisticated generic indicia that have already been provided on each disc 40. In other words, the complicated artwork can be generic artwork done in advance in step 110, with only relatively simple specific artwork added later in step 150. In addition to possibly simplifying step 150, doing as much work as possible on discs 40 in step 110 in advance of the need for those discs helps smooth out the workload of production equipment and personnel.

[0042] It will be understood that the foregoing is only illustrative of the principles of this invention. For example, protective lacquer layers 28 and 48 may not be

needed since the back of each disc 20 or 40 is ultimately protected by the other disc bonded to that disc.

5 Claims

1. An information recording medium (10) comprising:

a first substantially transparent plastic disc (20) having a first substantially planar surface (22) and a second surface (24) opposite to said first surface (22), said second surface (24) having information recorded on it by means of local changes in the distance of said second surface (24) from said first surface (22);

a first light reflecting coating (26) on said second surface (24) for reflecting light passed through said first disc (20) back through said first disc (20), said first coating (26) conforming to said local changes of said second surface (24) so that said light is reflected back through said first disc (20) in accordance with the information recorded by means of said local changes;

a second plastic disc (40) of approximately the same thickness as said first disc (20), said second disc (40) having opposite, substantially planar, third (44) and fourth surfaces, said second disc being stacked on and secured to said first disc (20) so that said third surface (44) faces toward said second surface (24); and indicia on said second disc (40) that are visible by viewing said fourth surface for visibly providing a user of said recording medium (10) with identifying information related to the recording medium, characterised by said indicia being formed by means of variations in the thickness of the plastic of said second disc (40) produced via local changes in the distance of said third surface (44) from said fourth surface.

2. The recording medium (10) defined in claim 1 wherein said indicia comprise local modifications of said fourth surface so that the distance of said fourth surface from said third surface (44) is different in said local modifications than elsewhere.

3. The recording medium (10) defined in claim 2 wherein said local modifications are thermally produced depressions in said fourth surface.

4. The recording medium (10) defined in claim 2 wherein said local modifications are laser produced depressions in said fourth surface.

5. The recording medium (10) defined in claim 1 wherein said second disc (40) is substantially transparent, and wherein said indicia comprise local

modifications of said third surface (44) so that the distance of said third surface (44) from said fourth surface is different in said local modifications than elsewhere.

6. The recording medium (10) defined in claim 5 further comprising:

a second visible light reflecting coating (46) on said third surface (44) for reflecting visible light passed through said second disc (40) back through said second disc (40), said second coating (46) conforming to said local modifications of said third surface so that said visible light is reflected back through said second disc (40) in accordance with said local modifications.

7. The recording medium (10) defined in claim 6 wherein said local modifications additionally comprise recording of additional information readable by the same means that said information recorded by means of said local changes is readable by.

8. The recording medium (10) defined in claim 7 wherein said additional information indicates that said second disc (40) is not the disc that contains said information recorded by means of said local changes.

9. The method of making recording media (10), at least some of which have respectively different first and second recorded program information, said method comprising the steps of:

forming a plurality of first substantially transparent plastic discs (20), each of which has a first substantially planar surface (22) and a second surface opposite to said first surface on which said first program information is recorded by means of local changes in the distance of said second surface from said first surface (22); coating said second surface of each of said first discs with a light reflecting coating (24) which reflects light passed through said first disc (20) back through said first disc (20), said coating conforming to said local changes of said second surface so that said light is reflected back through said first disc (20) in accordance with the information recorded by said local changes; repeating said forming and coating steps to produce a plurality of second discs which are substantially similar to said first discs (20) except that said second program information rather than said first program information is recorded on each of said second discs; forming a plurality of third substantially planar plastic discs (40), each of which has approximately the same thickness as one of said first or second discs (20), and each of which has in-

dicia that are common to all of said third discs (40), said indicia being visible to a user of said recording media for visibly providing the user with identifying information about the recording media characterised by, said indicia being formed by means of variations in the thickness of the plastic of said third discs (40); and bonding a respective one of said third discs (40) to each of said first and second discs (20) so that the bonded discs form a permanent two-disc stack (10) with the third disc (40) being adjacent to said second surface (24) of the associated first or second disc (20) and with the indicia on said third disc (40) being still visible in said stack.

10. The method defined in claim 9 wherein said step of forming a plurality of third discs (40) comprises the step of:

modifying a substantially planar surface of each of said third discs (40) to represent said indicia.

11. The method defined in claim 10 wherein said modifying step comprises the step of:

changing the thickness of each of said third discs (40) where said substantially planar surface of said disc is modified to represent said indicia.

12. The method defined in claim 11 wherein said changing step comprises the step of:

thermally depressing (116a) portions of said substantially planar surface of each of said third discs (40).

13. The method defined in claim 11 wherein said changing step comprises the step of:

using a laser to depress portions (116b) of said substantially planar surface of each of said third discs (40).

14. The method defined in claim 10 wherein each of said third discs (40) is substantially transparent, and wherein said step of forming a plurality of third discs (40) further comprises the step of:

after said modifying step, coating said substantially planar surface of each of said third discs (40) with a visible light reflecting coating (46) which reflects visible light passed through said third disc back through said third disc, said coating (46) on said third disc (40) conforming to modifications of said substantially planar surface so that said visible light is reflected back through said third disc (40) in accordance with the indicia represented by said modifications.

15. The method defined in claim 14 wherein said bonding step comprises the preliminary step of:

orienting each of said third discs (40) so that said coating (46) on said third disc (40) will be adjacent to said second surface (24) of said first or second disc (20) in the stack that includes said third disc (40).

16. The method defined in claim 15 wherein said step of forming said plurality of third discs (40) comprises the step of:

additionally modifying said substantially planar surface of each of said third discs (40) to record on said third disc additional information (88) that is readable by the same means that said first and second program information recorded on said first and second discs (20) is readable by.

17. The method defined in claim 16 wherein said additional information (88) indicates that said third disc (40) is not a disc that contains information of the type of said first or second program information.

18. The method defined in claim 9 further comprising the step of:

after said bonding step, applying additional indicia (80, 82, 84, 86) to the third disc (40) of each of said stacks, said additional indicia (80, 82, 84, 86) being visible to said user for providing said user with additional information which indicates whether said stack includes one of said first discs (20) containing said first program information or one of said second discs (20) containing said second program information.

19. The method defined in claim 18 wherein said step of applying additional indicia (80, 82, 84, 86) comprises the step of:

printing said additional indicia (80, 82, 84, 86) on an exposed, substantially planar surface of said third disc (40) in said stack.

20. The method defined in claim 18 wherein said step of applying additional indicia (80, 82, 84, 86) comprises the step of:

securing a label containing said additional indicia (80, 82, 84, 86) to an exposed, substantially planar surface of said third disc (40) in said stack.

21. The method defined in claim 18 wherein said step of applying additional indicia (80, 82, 84, 86) comprises the step of:

securing a paper label printed with said additional indicia (80, 82, 84, 86) to an exposed, substantially planar surface of said third disc (40) in said stack.

22. The method defined in claim 18 wherein said step of applying additional indicia (80, 82, 84, 86) comprises the step of:

modifying an exposed, substantially planar surface of said third disc (40) in said stack to represent said additional indicia (80, 82, 84, 86).

23. The method defined in claim 22 wherein said modifying step comprises the step of:

changing the thickness of said third disc (40) in said stack where said exposed, substantially planar surface of said third disc is modified to represent said additional indicia (80, 82, 84, 86).

24. The method defined in claim 23 wherein said changing step comprises the step of:

thermally depressing (116a) portions of said exposed, substantially planar surface of said third disc (40) in said stack.

25. The method defined in claim 23 wherein said changing step comprises the step of:

using a laser to depress (116b) portions of said exposed, substantially planar surface of said third disc (40) in said stack.

Patentansprüche

1. ein Informationsaufzeichnungsmedium (10), das aufweist:

eine erste im Wesentlichen transparente Kunststoffscheibe (20), die eine im Wesentlichen ebene erste Oberfläche (22) und eine dieser ersten Oberfläche (22) gegenüberliegende zweite Oberfläche (24) hat, wobei auf der zweiten Oberfläche (24) mittels örtlicher Änderungen der Distanz dieser zweiten Oberfläche (24) von der ersten Oberfläche (22) Informationen aufgezeichnet sind;

eine erste lichtreflektierende Beschichtung (26) auf der zweiten Oberfläche (24), um Licht, das durch diese erste Scheibe (20) geht, durch diese erste Scheibe (20) zurückzureflektieren, wobei die erste Beschichtung (26) an die örtlichen Änderungen der, zweiten Oberfläche (24) angepaßt ist, so dass das Licht gemäß der Information, die mittels der örtlichen Änderungen aufgezeichnet ist, durch die erste Scheibe (20) zurückreflektiert wird;

eine zweite Kunststoffscheibe (40) mit ungefähr derselben Dicke wie die erste Scheibe (20), wobei die zweite Scheibe (40) einander gegenüberliegende, im Wesentlichen ebene dritte (44) und vierte Oberflächen hat, wobei die zweite Scheibe auf die erste Scheibe (20) gestapelt und an ihr so befestigt ist, dass die dritte Oberfläche (44) der zweiten Oberfläche (24) gegenüberliegt; und
Kennzeichen auf der zweiten Scheibe (40), die

- beim Ansehen der vierten Oberfläche sichtbar sind, um einen Nutzer des Aufzeichnungsmediums (10) visuell mit identifizierenden Informationen, die mit dem Aufzeichnungsmedium verbunden sind, zu versorgen, dadurch gekennzeichnet, dass diese Kennzeichen mittels Änderungen der Dicke des Kunststoffes der zweiten Scheibe (40) geformt werden, die über örtliche Änderungen in der Distanz der dritten Oberfläche zur vierten Oberfläche hergestellt werden. 10
2. Das Aufzeichnungsmedium (10) nach Anspruch 1, wobei die Kennzeichen örtliche Änderungen der vierten Oberfläche aufweisen, so dass die Distanz der vierten Oberfläche von der dritten Oberfläche (44) in den örtlichen Änderungen anders als anderswo ist. 15
3. Das Aufzeichnungsmedium (10) nach Anspruch 2, wobei die örtlichen Änderungen thermisch produzierte Einpressungen in der vierten Oberfläche sind. 20
4. Das Aufzeichnungsmedium (10) nach Anspruch 2, wobei die örtlichen Änderungen Laser-produzierte Einpressungen in der vierten Oberfläche sind. 25
5. Das Aufzeichnungsmedium (10) nach Anspruch 1, wobei die zweite Scheibe (40) im Wesentlichen transparent ist, und wobei die Kennzeichen örtliche Änderungen der dritten Oberfläche (44) aufweisen, so dass die Distanz der dritten Oberfläche (44) von der vierten Oberfläche in den örtlichen Änderungen unterschiedlich von der Distanz anderswo ist. 30 35
6. Das Aufzeichnungsmedium (10) nach Anspruch 5, das weiter aufweist:
eine zweite Beschichtung (46) auf der dritten Oberfläche (44), die sichtbares Licht reflektiert, um sichtbares Licht, das durch die zweite Scheibe (40) fällt, durch die zweite Scheibe (40) zurückzereflektieren, wobei sich die zweite Beschichtung (46) den örtlichen Änderungen der dritten Oberfläche so anpaßt, dass das sichtbare Licht in Übereinstimmung mit den örtlichen Änderungen durch die zweite Scheibe (40) zurückreflektiert wird. 40 45
7. Das Aufzeichnungsmedium (10) nach Anspruch 6, wobei die örtlichen Änderungen zusätzlich Aufzeichnungen von zusätzlicher Information aufweisen, die mit demselben Mittel gelesen werden können, das die mittels der örtlichen Änderungen aufgezeichnete Information lesen kann. 50
8. Das Aufzeichnungsmedium (10) nach Anspruch 7, wobei die zusätzlichen Informationen anzeigen, dass die zweite Scheibe (40) nicht die Scheibe ist, die die Informationen enthält, die mittels der örtli-

chen Änderungen aufgezeichnet wurden.

9. Ein Verfahren zur Herstellung von Aufzeichnungsmedien (10), von denen zumindest einige unterschiedliche erste und zweite aufgezeichnete Programminformationen haben, wobei das Verfahren folgende Schritte aufweist:

Formen einer Vielzahl von ersten im Wesentlichen transparenten Kunststoffscheiben (20), von denen jede eine erste im Wesentlichen ebene Oberfläche (22) und eine zweite Oberfläche, die der ersten Oberfläche gegenüberliegt, hat, auf der die erste Programminformation mittels örtlicher Änderungen in der Distanz der zweiten Oberfläche von der ersten Oberfläche (22) aufgezeichnet ist;
Beschichten dieser zweiten Oberfläche jeder dieser ersten Scheiben mit einer lichtreflektierenden Schicht (24), die Licht, das durch die erste Scheibe (20) fällt, durch diese erste Scheibe (20) zurückreflektiert, wobei die Beschichtung an die örtlichen Änderungen der zweiten Oberfläche angepaßt ist, so dass das Licht durch die erste Scheibe (20) gemäß der Informationen, die durch die örtlichen Änderungen aufgezeichnet sind, zurückreflektiert wird;
Wiederholen der Formungs- und Beschichtungsschritte, um eine Vielzahl von zweiten Scheiben zu produzieren, die im Wesentlichen den ersten Scheiben (20) ähnlich sind, mit der Ausnahme, dass die zweite Programminformation anstelle der ersten Programminformation auf jeder dieser zweiten Scheiben aufgezeichnet ist;
Formen einer Mehrzahl von dritten im Wesentlichen ebenen Kunststoffscheiben (40) von denen jede ungefähr die gleiche Dicke wie eine der ersten oder zweiten Scheiben (20) hat, und wobei die dritten Scheiben (40) alle in gleicher Weise Kennzeichen haben, wobei die Kennzeichen für einen Nutzer der Aufzeichnungsmedien sichtbar sind, um den Nutzer visuell mit Identifikationsinformation über die Aufzeichnungsmedien zu versorgen, dadurch gekennzeichnet, dass die Kennzeichen mittels Variationen in der Dicke des Kunststoffes der dritten Scheiben (40) geformt werden;
und Verbinden einer zugehörigen der dritten Scheiben (40) zu jeder der ersten und zweiten Scheiben (20), so dass die verbundenen Scheiben einen dauerhaften Zwei-Scheiben-Stapel (10) formen, wobei die dritte Scheibe (40) benachbart zur zweiten Oberfläche (24) der vereinigten ersten oder zweiten Scheibe (20) und mit der Kennzeichnung auf der dritten Scheibe (40) so, dass diese lesbar ist, in diesem Stapel liegt.

10. Ein Verfahren nach Anspruch 9, wobei der Schritt des Formens einer Vielzahl von dritten Scheiben (40) den folgenden Schritt aufweist: Modifizieren einer im Wesentlichen ebenen Oberfläche jeder der dritten Scheiben (40), um die Kennzeichnung zu repräsentieren. 5
11. Ein Verfahren nach Anspruch 10, in der der Änderungsschritt folgenden Schritt aufweist:
Änderung der Dicke jeder der dritten Scheiben (40) dort, wo die im Wesentlichen ebene Oberfläche der Scheibe modifiziert wird, um die Kennzeichnung zu repräsentieren. 10
12. Ein Verfahren nach Anspruch 11, in der der Änderungsschritt folgenden Schritt aufweist:
thermisches Niederdrücken (116a) von Teilen der im Wesentlichen ebenen Oberfläche jeder der dritten Scheiben (40). 15
13. Ein Verfahren nach Anspruch 11, wobei der Änderungsschritt folgenden Schritt aufweist:
Nutzen eines Lasers, um Teile (116b) der im Wesentlichen ebenen Oberfläche jeder der dritten Scheiben (40) zu pressen. 20
14. Ein Verfahren nach Anspruch 10, wobei jede der dritten Scheiben (40) im Wesentlichen transparent ist, und wobei der Schritt des Formens einer Vielzahl von dritten Scheiben (40) weiterhin folgenden Schritt aufweist:
Beschichten der im Wesentlichen ebenen Oberfläche jeder der dritten Scheiben (40) nach dem Änderungsschritt mit einer sichtbares Licht reflektierenden Beschichtung (46), die sichtbares Licht, das durch die dritte Scheibe fällt, durch die dritte Scheibe zurückreflektiert, wobei die Beschichtung (46) auf der dritten Scheibe (40) an die Modifikationen der im Wesentlichen ebenen Oberfläche so angepaßt ist, dass das sichtbare Licht durch die dritte Scheibe (40) in Übereinstimmung mit den Kennzeichen, die von diesen Modifikationen repräsentiert werden, zurückreflektiert wird. 25
15. Ein Verfahren nach Anspruch 14, wobei der Verbindungsschritt den folgenden zuvor kommenden Schritt aufweist: Ausrichtung jeder der dritten Scheiben (40) so, dass die Beschichtung (46) auf der dritten Scheibe (40) benachbart zur zweiten Oberfläche (24) der ersten oder zweiten Scheibe (20) in dem Stapel liegt, der die dritte Scheibe (40) enthält. 30
16. Ein Verfahren nach Anspruch 15, wobei der Schritt des Formens der Vielzahl von dritten Scheiben (40) folgenden Schritt aufweist:
zusätzliches Abändern der im Wesentlichen ebenen Oberfläche jeder der dritten Scheiben (40), um zusätzliche Informationen (88) auf der dritten Scheibe aufzuzeichnen, die mit demselben Mittel lesbar ist, mit dem die erste und zweite Programminformation, die auf die ersten und zweiten Scheiben (20) aufgezeichnet ist, lesbar ist. 35
17. Ein Verfahren nach Anspruch 16, wobei die zusätzliche Information (88) anzeigt, dass die dritte Scheibe (40) keine Scheibe ist, die Informationen des Typs der ersten oder zweiten Programminformation enthält. 40
18. Ein Verfahren nach Anspruch 9, die weiterhin folgenden Schritt aufweist:
Anbringen zusätzlicher Kennzeichen (80, 82, 84, 86) an der dritten Scheibe (40) in jedem der Stapel nach dem Verbindungsschritt, wobei die zusätzliche Kennzeichnung (80, 82, 84, 86) für den Nutzer sichtbar ist, um dem Nutzer zusätzliche Informationen bereitzustellen, die anzeigen, ob der Stapel eine jener ersten Scheiben (20) beinhaltet, die die erste Programminformation enthält, oder eine der zweiten Scheiben (20) beinhaltet, die die zweite Programminformation enthält. 45
19. Ein Verfahren nach Anspruch 18, in der der Schritt der Anbringung zusätzlicher Kennzeichen (80, 82, 84, 86) folgenden Schritt aufweist:
Drucken der zusätzlichen Kennzeichen (80, 82, 84, 86) auf eine außenliegende, im Wesentlichen ebene Oberfläche der dritten Scheibe (40) im Stapel. 50
20. Ein Verfahren nach Anspruch 18, wobei der Schritt der Anbringung zusätzlicher Kennzeichen (80, 82, 84, 86) folgenden Schritt aufweist:
Befestigen eines Etiketts, das die zusätzlichen Kennzeichen (80, 82, 84, 86) enthält, auf einer außenliegenden, im Wesentlichen ebenen Oberfläche der dritten Scheibe (40) im Stapel. 55
21. Ein Verfahren nach Anspruch 18, wobei der Schritt des Anbringens weiterer Kennzeichen (80, 82, 84, 86) folgenden Schritt aufweist:
Befestigen eines Papieretiketts, auf das die zusätzlichen Kennzeichen (80, 82, 84, 86) gedruckt sind, an einer außenliegenden, im Wesentlichen ebenen Oberfläche der dritten Scheibe (40) im Stapel. 60
22. Ein Verfahren nach Anspruch 18, wobei der Schritt des Anbringens weiterer Kennzeichen (80, 82, 84, 86) weiterhin folgenden Schritt aufweist: Verändern einer außenliegenden, im Wesentlichen ebenen Oberfläche der dritten Scheibe (40) im Stapel, um die zusätzlichen Kennzeichen (80, 82, 84, 86) wiederzugeben. 65

23. Ein Verfahren nach Anspruch 22, wobei der Änderungsschritt folgenden Schritt aufweist: Verändern der Dicke der dritten Scheibe (40) im Stapel dort, wo die außenliegende, im Wesentlichen ebene Oberfläche der dritten Scheibe modifiziert ist, um die zusätzlichen Kennzeichen (80, 82, 84, 86) wiederzugeben.
24. Ein Verfahren nach Anspruch 23, wobei der Änderungsschritt folgenden Schritt aufweist: thermisches Pressen (116a) von Teilen der außenliegenden, im Wesentlichen ebenen Oberfläche der dritten Scheibe (40) im Stapel.
25. Ein Verfahren nach Anspruch 23, wobei der Änderungsschritt folgenden Schritt aufweist: Nutzung eines Lasers, um Teile (116b) der außenliegenden, im Wesentlichen ebenen Oberfläche der dritten Scheibe (40) im Stapel zu pressen.

Revendications

1. Moyen d'enregistrement d'informations (10), comprenant :
- un premier disque de matière plastique essentiellement transparent (20) comportant une première surface essentiellement plane (22) et une seconde surface (24) opposée à la première surface (22), la seconde surface (24) comportant des informations enregistrées sur celle-ci au moyen de changements locaux de la distance de cette seconde surface (24) à la première surface (22) ;
 - un premier revêtement réfléchissant la lumière (26) formé sur la seconde surface (24) pour réfléchir la lumière ayant traversé le premier disque (20) de manière à la renvoyer à travers ce premier disque (20), le premier revêtement (26) se conformant aux changements locaux de la seconde surface (24), de façon que la lumière soit réfléchi à travers le premier disque (20) suivant l'information enregistrée au moyen des changements locaux ;
 - un second disque de matière plastique (40) présentant approximativement la même épaisseur que le premier disque (20), ce second disque (40) comportant des troisième (44) et quatrième surfaces, essentiellement planes, le second disque étant empilé et fixé sur le premier disque (20) de façon que la troisième surface (44) soit tournée vers la seconde surface (24) ; et
 - des repères formés sur le second disque (40) et visibles en regardant la quatrième surface, pour fournir de manière visible à un utilisateur du moyen d'enregistrement (10) une informa-

tion d'identification concernant le moyen d'enregistrement,

caractérisé en ce que les repères sont formés au moyen de variations d'épaisseur de la matière plastique du second disque (40), ces variations d'épaisseur étant produites par des changements locaux de la distance de la troisième surface (44) à la quatrième surface.

2. Moyen d'enregistrement (10) selon la revendication 1, dans lequel les repères comprennent des modifications locales de la quatrième surface, de façon que la distance de la quatrième surface à la troisième surface (44) soit dans ces modifications locales différente de ce qu'elle est ailleurs.
3. Moyen d'enregistrement (10) selon la revendication 2, dans lequel les modifications locales sont des enfoncements produits thermiquement dans la quatrième surface.
4. Moyen d'enregistrement (10) selon la revendication 2, dans lequel les modifications locales sont des enfoncements produits par un laser dans la quatrième surface.
5. Moyen d'enregistrement (10) selon la revendication 1, dans lequel le second disque (40) est essentiellement transparent, et les repères comprennent des modifications locales de la troisième surface (44), de façon que la distance de cette troisième surface (44) à la quatrième surface, soit dans ces modifications locales différente de ce qu'elle est ailleurs.
6. Moyen d'enregistrement (10) selon la revendication 5, comprenant en outre un second revêtement réfléchissant la lumière visible (46), sur la troisième surface (44), pour réfléchir la lumière visible ayant traversé le second disque (40), de manière à la renvoyer à travers ce second disque (40), le second revêtement (46) se conformant aux modifications locales de la troisième surface, de façon que la lumière visible soit réfléchi à travers le second disque (40) suivant les modifications locales.
7. Moyen d'enregistrement (10) selon la revendication 6, dans lequel les modifications locales comprennent en outre

l'enregistrement d'informations supplémentaires lisibles par les mêmes moyens que les informations enregistrées à l'aide des changements locaux.

8. Moyen d'enregistrement (10) selon la revendication 7, dans lequel l'information supplémentaire indique que le second disque (40) n'est pas le disque qui contient l'information enregistrée à l'aide des changements locaux. 5
9. Procédé de fabrication de moyens d'enregistrement (10) dont l'un au moins comporte des informations d'un premier programme et d'un second programme enregistrés, respectivement différents, ce procédé comprenant les étapes consistant à : 10
 - former un certain nombre de premiers disques de matière plastique essentiellement transparents (20) comportant chacun une première surface essentiellement plane (22) et une seconde surface, opposée à la première surface, sur laquelle l'information de premier programme est enregistrée au moyen de changements locaux de la distance de la seconde surface à la première surface (22) ; 15
 - recouvrir la seconde surface de chacun des premiers disques par un revêtement réflecteur de lumière (24) qui réfléchit la lumière ayant traversé le premier disque (20) pour la renvoyer à travers ce premier disque (20), le revêtement se conformant aux changements locaux de la seconde surface de façon que la lumière soit réfléchie pour repasser à travers le premier disque (20) suivant l'information enregistrée par les changements locaux ; 20
 - répéter les étapes de formation et de revêtement pour produire un certain nombre de seconds disques essentiellement analogues aux premiers disques (20), sauf qu'une information de second programme est enregistrée sur chacun des seconds disques, au lieu de l'information de premier programme ; 25
 - former un certain nombre de troisièmes disques de matière plastique essentiellement plans (40) ayant approximativement chacun la même épaisseur que l'un des premiers ou seconds disques (20), et comportant chacun des repères communs à tous les troisièmes disques (40), ces repères étant visibles pour un utilisateur des moyens d'enregistrement de manière à lui fournir une information d'identification visible concernant les moyens d'enregistrement, cette information se caractérisant en ce que les repères sont formés au moyen de variations de l'épaisseur de la matière plastique des troisièmes disques (40) ; et 30

- coller l'un, respectif, des troisièmes disques (40) à chacun des premiers et seconds disques (20) de façon que les disques collés forment une pile de deux disques permanents (10) dans laquelle le troisième disque (40) est adjacent à la seconde surface (24) du premier disque ou du second disque (20) associé, et dans laquelle les repères se trouvant sur le troisième disque (40) sont toujours visibles dans la pile.

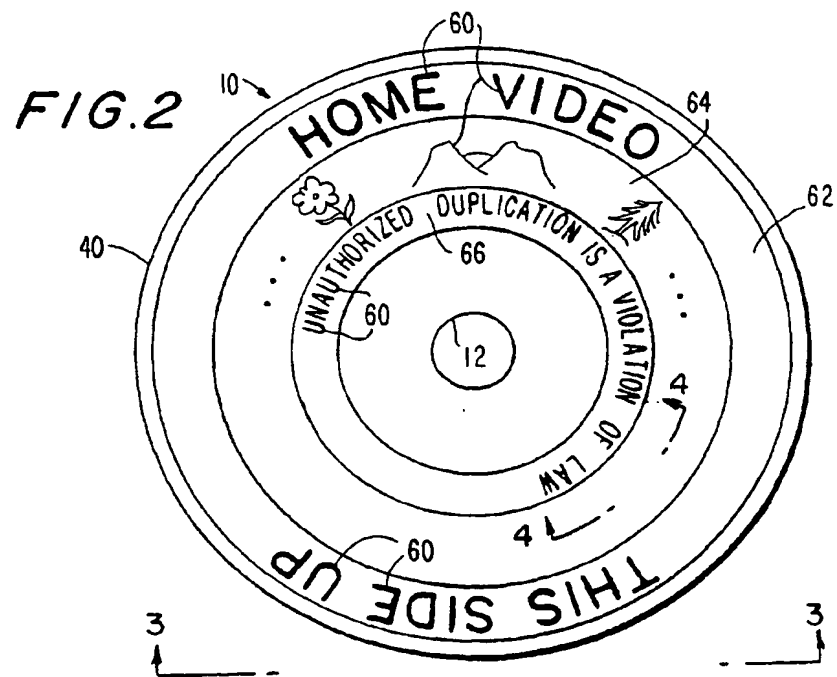
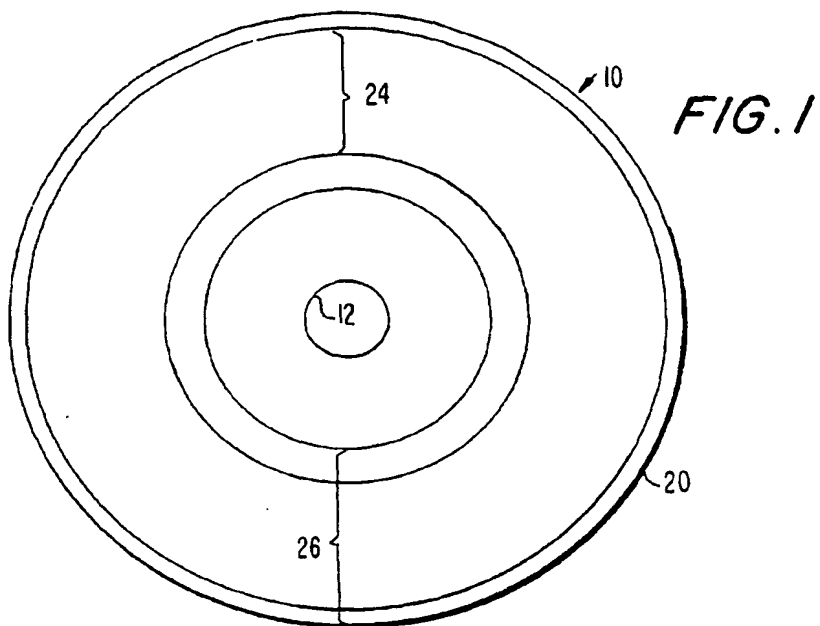
10. Procédé selon la revendication 9, dans lequel l'étape de formation d'une pluralité de troisièmes disques (40) comprend l'étape consistant à : modifier une surface essentiellement plane de chacun des troisièmes disques (40) pour représenter les repères.
11. Procédé selon la revendication 10, dans lequel l'étape de modification comprend l'étape consistant à : changer l'épaisseur de chacun des troisièmes disques (40) de façon que la surface essentiellement plane de ce disque soit modifiée pour représenter les repères.
12. Procédé selon la revendication 11, dans lequel l'étape de changement comprend l'étape consistant à : enfoncer thermiquement des parties (116a) de la surface essentiellement plane de chacun des troisièmes disques (40).
13. Procédé selon la revendication 11, dans lequel l'étape de changement comprend l'étape consistant à : utiliser un laser pour enfoncer des parties (116b) de la surface essentiellement plane de chacun des troisièmes disques (40).
14. Procédé selon la revendication 10, dans lequel chacun des troisièmes disques (40) est essentiellement transparent, et l'étape de formation d'une pluralité de troisièmes disques (40) comprend en outre l'étape consistant à : après l'étape de modification, revêtir la surface essentiellement plane de chacun des troisièmes disques (40) par un revêtement réflecteur de lumière visible (46) qui réfléchit la lumière visible ayant traversé le troisième disque pour la faire repasser à travers ce troisième disque, le revêtement (46) se trouvant sur le troisième disque (40) se conformant aux modifications de la surface essentiellement plane, de façon que la lumière visible soit réfléchie 55

pour repasser à travers le troisième disque (40) suivant les repères représentés par ces modifications.

15. Procédé selon la revendication 14, dans lequel l'étape de collage comprend l'étape préliminaire consistant à : orienter chacun des troisièmes disques (40) de façon que le revêtement (46) se trouvant sur le troisième disque (40) soit adjacent à la seconde surface (24) du premier disque ou du second disque (20) dans la pile comprenant ce troisième disque (40). 5
16. Procédé selon la revendication 15, dans lequel l'étape de formation de la pluralité de troisièmes disques (40) comprend l'étape consistant à : modifier en outre la surface essentiellement plane de chacun des troisièmes disques (40) pour enregistrer, sur ce troisième disque, une information supplémentaire (88) lisible par les mêmes moyens que ceux qui lisent les informations de premier programme et de second programme enregistrées sur les premier et second disques (20). 10 20
17. Procédé selon la revendication 16, dans lequel l'information supplémentaire (88) indique que le troisième disque (40) n'est pas un disque contenant une information du type des informations des premier ou second programmes. 30
18. Procédé selon la revendication 9, comprenant en outre l'étape consistant à : après l'étape de collage, appliquer les repères supplémentaires (80, 82, 84, 86) sur le troisième disque (40) de chacune des piles, ces repères supplémentaires (80, 82, 84, 86) étant visibles par l'utilisateur pour lui fournir une information supplémentaire indiquant si la pile comprend l'un des premiers disques (20) contenant l'information de premier programme, ou l'un des seconds disques (20) contenant l'information de second programme. 35 40
19. Procédé selon la revendication 18, dans lequel l'étape d'application des repères supplémentaires (80, 82, 84, 86) comprend l'étape consistant à : imprimer les repères supplémentaires (80, 82, 84, 86) sur une surface essentiellement plane, exposée, du troisième disque (40) dans la pile. 45 50
20. Procédé selon la revendication 18, dans lequel l'étape d'application des repères supplémentaires (80, 82, 84, 86) comprend l'étape consistant à : fixer une étiquette contenant les repères supplémentaires (80, 82, 84, 86) sur une surface essen- 55

tiellement plane, exposée, du troisième disque (40) dans la pile.

21. Procédé selon la revendication 18, dans lequel l'étape d'application de repères supplémentaires (80, 82, 84, 86) comprend l'étape consistant à : fixer une étiquette en papier sur laquelle sont imprimés les repères supplémentaires (80, 82, 84, 86), sur une surface essentiellement plane, exposée, du troisième disque (40) dans la pile. 5
22. Procédé selon la revendication 18, dans lequel l'étape d'application de repères supplémentaires (80, 82, 84, 86) comprend l'étape consistant à : modifier une surface essentiellement plane, exposée, du troisième disque (40) dans la pile, pour représenter les repères supplémentaires (80, 82, 84, 86). 10 20
23. Procédé selon la revendication 22, dans lequel l'étape de modification comprend l'étape consistant à : changer l'épaisseur du troisième disque (40) dans la pile de façon que la surface essentiellement plane, exposée, du troisième disque, soit modifiée pour représenter les repères supplémentaires (80, 82, 84, 86). 25 30
24. Procédé selon la revendication 23, dans lequel l'étape de changement comprend l'étape consistant à : enfoncer thermiquement des parties (116a) de la surface essentiellement plane, exposée, du troisième disque (40) dans la pile. 35 40
25. Procédé selon la revendication 23, dans lequel l'étape de changement comprend l'étape consistant à : utiliser un laser pour enfoncer des parties (116b) de la surface essentiellement plane, exposée, du troisième disque (40) dans la pile. 45 50 55



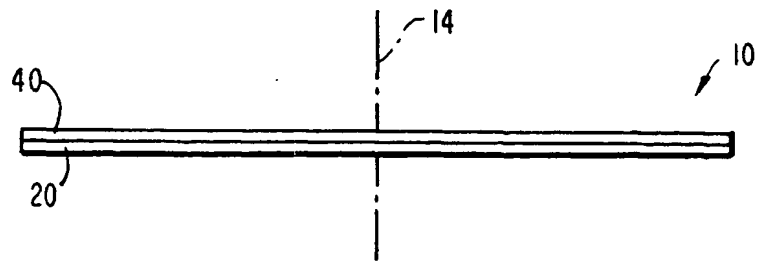


FIG. 3

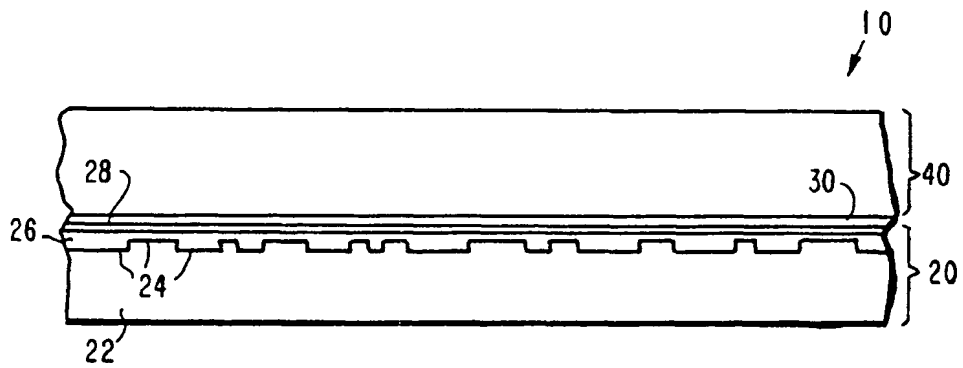
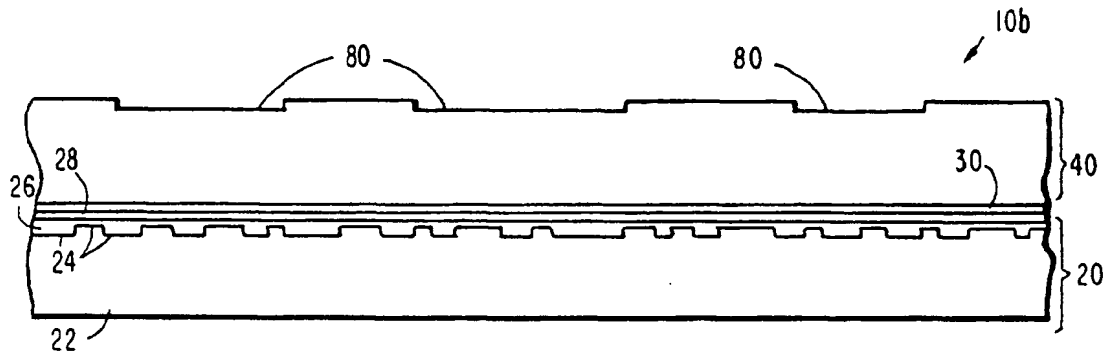
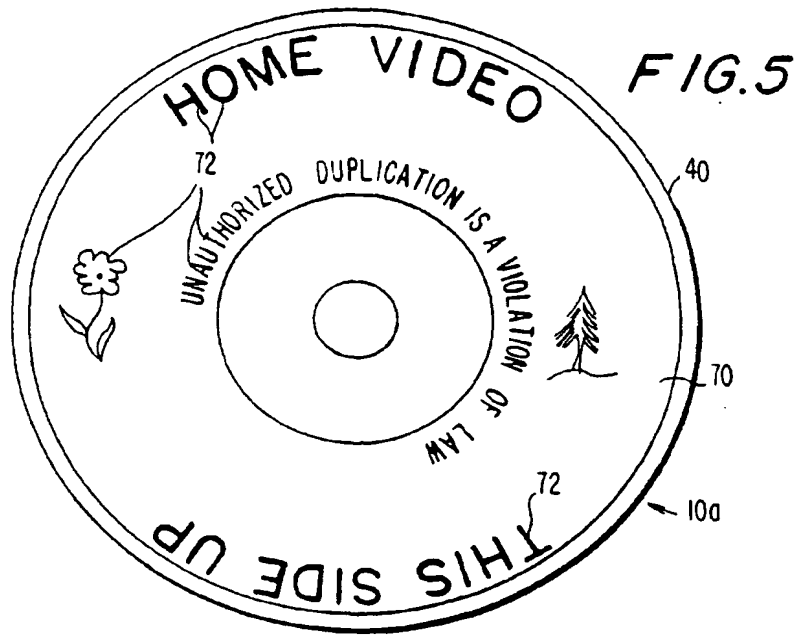


FIG. 4



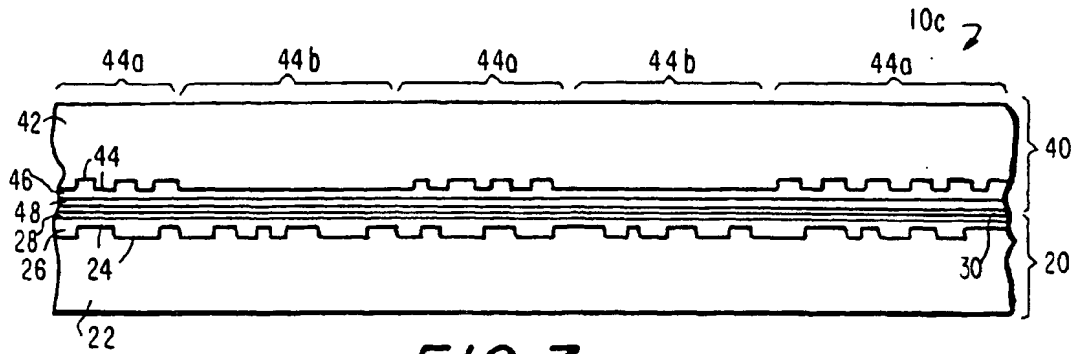


FIG. 7

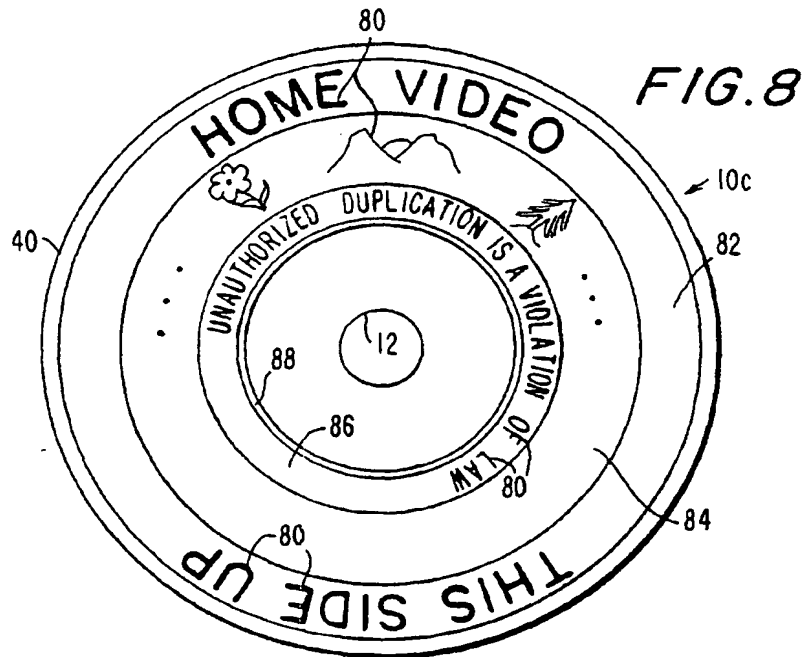


FIG. 8

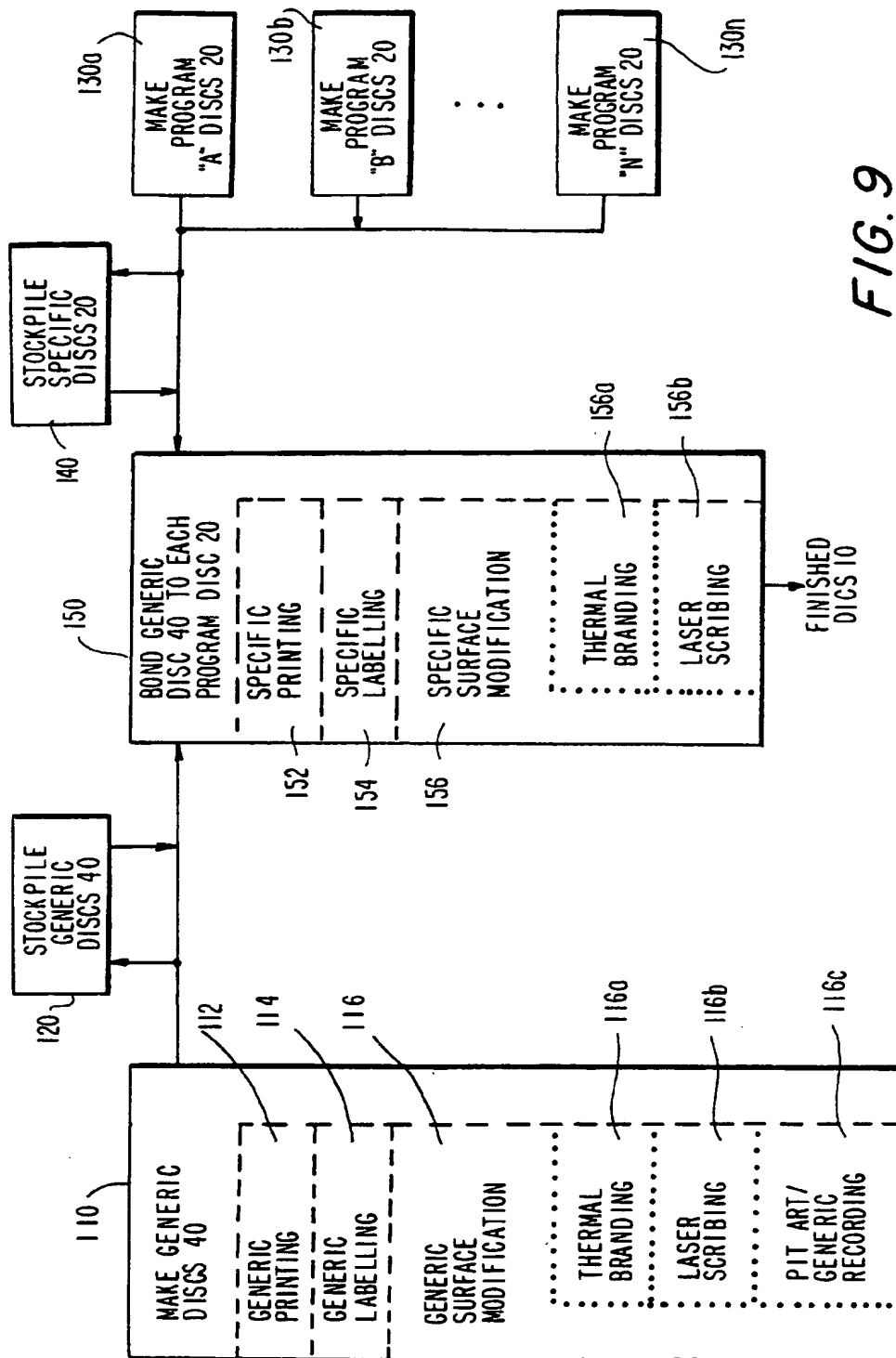


FIG. 9

FIG. 10

